

*Escape Completion Process Reduces Gas Emissions  
and Speeds Well Completions*



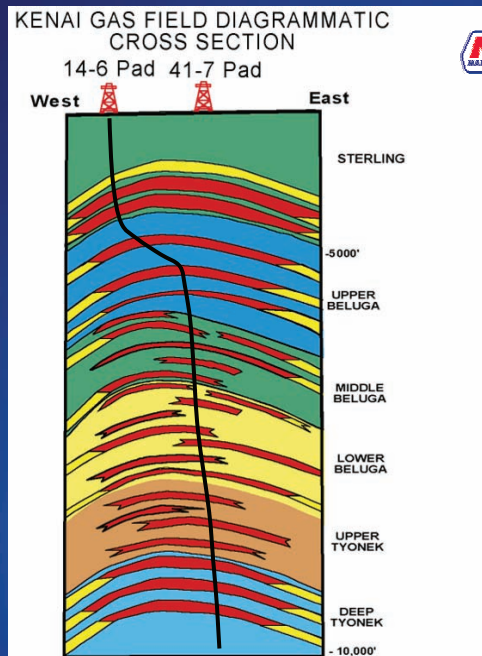
*EPA Natural Gas STAR  
Technology Transfer Workshop  
Denver, Colorado  
April, 2008*

**Marathon** 

**Original Driver for the Technology Development:  
Cook Inlet, Alaska Beluga Gas Sands** 

- ◆ 10 to 20 sand bodies typically encountered
- ◆ 1700' gross interval
- ◆ Each sand 5' to 30' thick
- ◆ Permeability 0.01 to 3 md
- ◆ Unfrac'd well rate 500 to 1,000 mcf/d. Some individual sands too tight to produce without stimulation.

How am  
I going  
to frac  
this???



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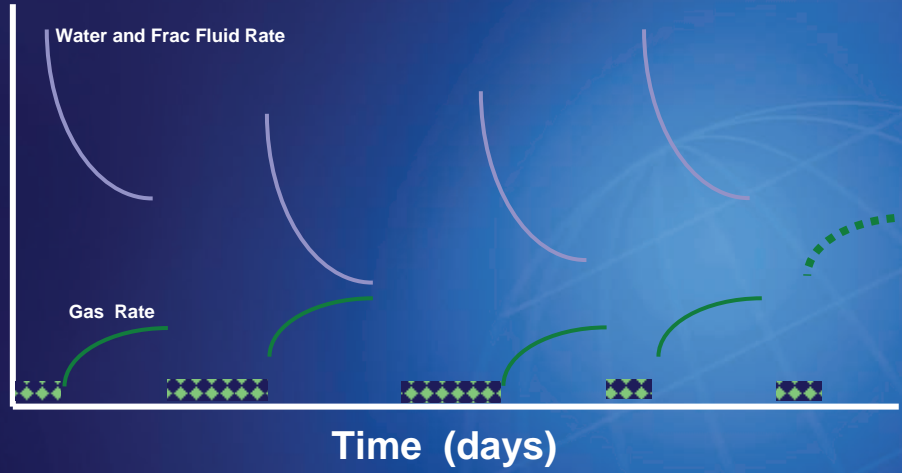
## Conventional Industry Solution

*a few years ago*

- ♦ **Common stimulation technique**
  - “cherry pick” individual zones
  - Perforate and attempt to stimulate multiple intervals
  - Flow back (venting gas)
  - Isolate lower intervals
  - (repeat process multiple times)
  - Remove all isolation devices and flow well.
- ♦ **Not very effective**
  - Inevitably bypass much pay
  - Compromise stimulation design
  - Time consuming and costly
  - Infrastructure issues in certain locations

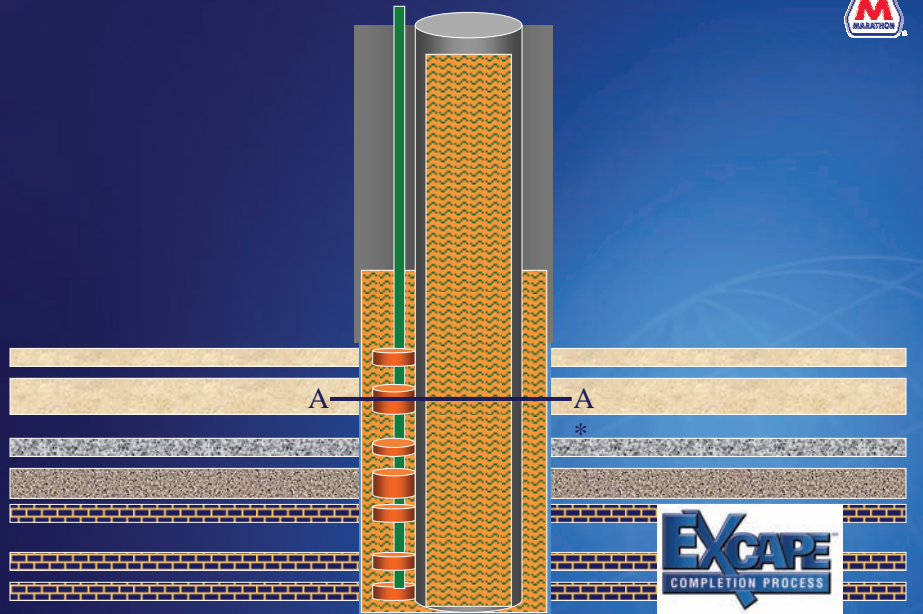
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# Conventional Well Completion

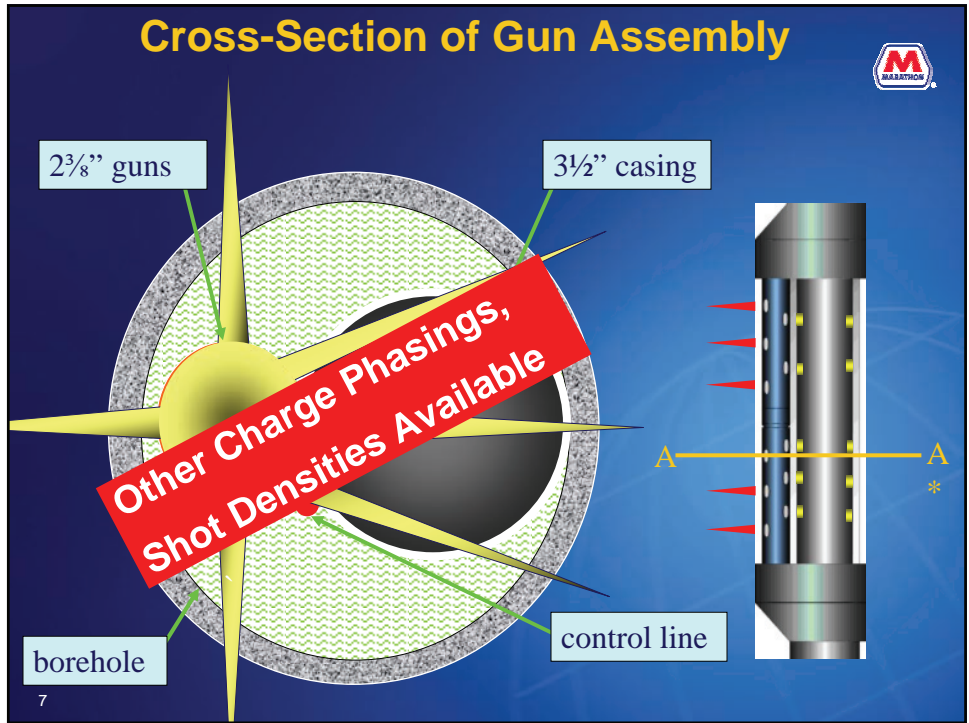


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# Casing Conveyed Perforating Completion



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### Isolation Valve Below External Perforating Gun

- ◆ Firing the gun actuates a lower isolation valve.
- ◆ Valve actuates when a protective sleeve shifts.
  - Compatible with cementing and fracturing operations
- ◆ Frangible; flapper valve removal is usually easy
  - with past knowledge.
  - Marathon, typically 15 in one hour

MARATHON

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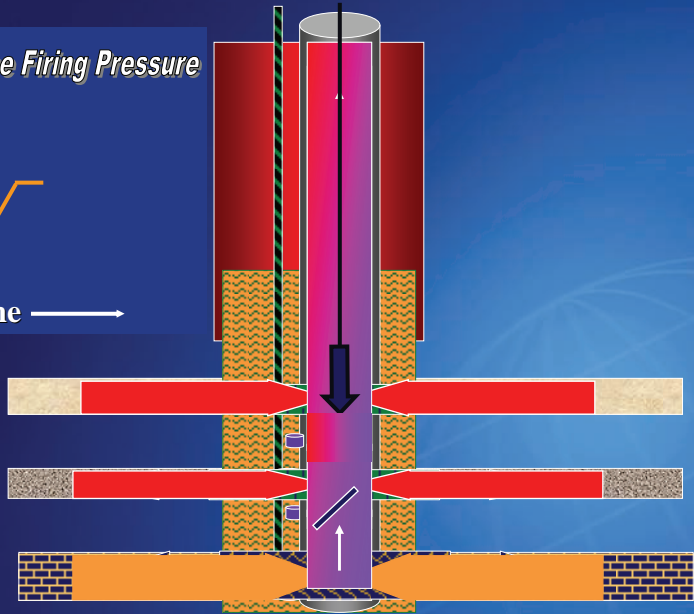
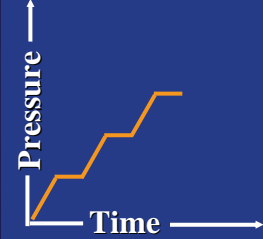
# Module Placement



West Texas Rig

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## Control Line Firing Pressure



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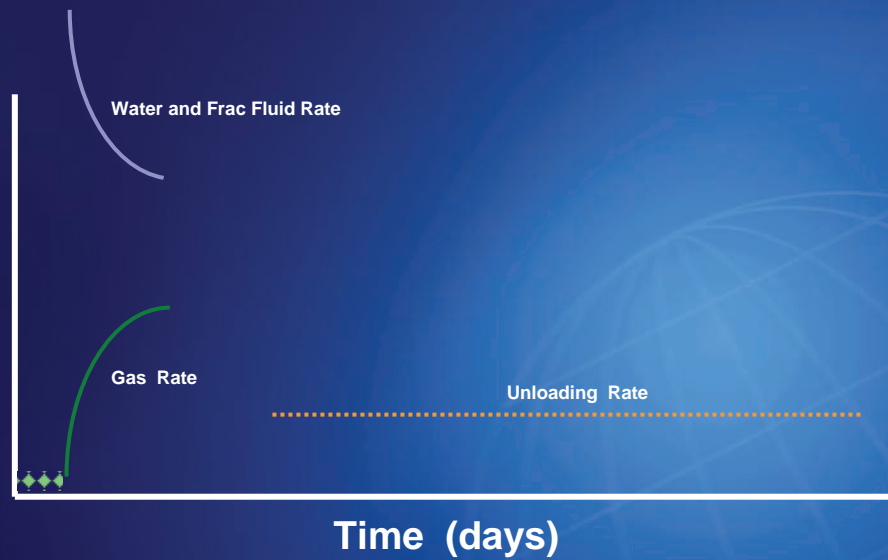
## Technical Achievements Marathon Alaska



- ◆ **Single Day Completion – 24 hour period**
  - 16 stages fracture stimulated
  - with well cleanout and isolation valve removal
  - gas to sales within 30 hours

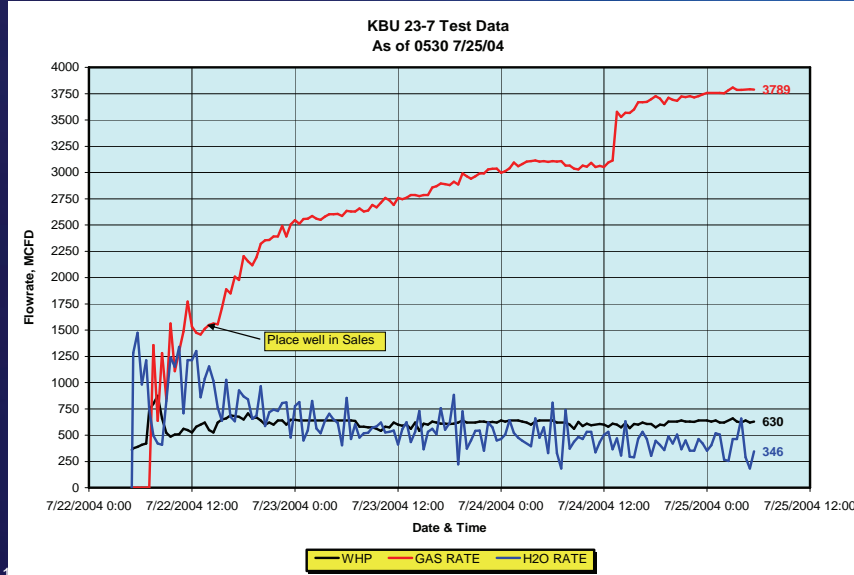
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## Escape Well Completion



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# Marathon Alaska Escape Well Post –Completion Production Data

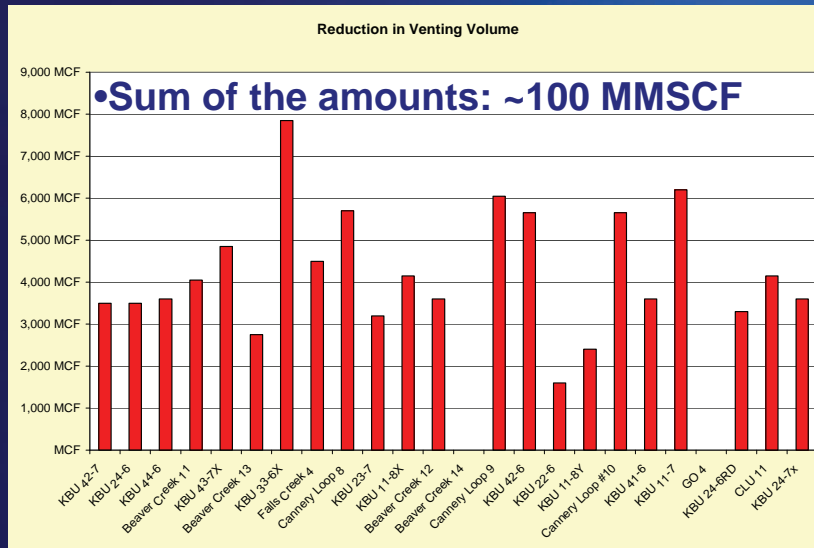


# How Much Gas Was Not Vented? Marathon Alaska Escape Wells



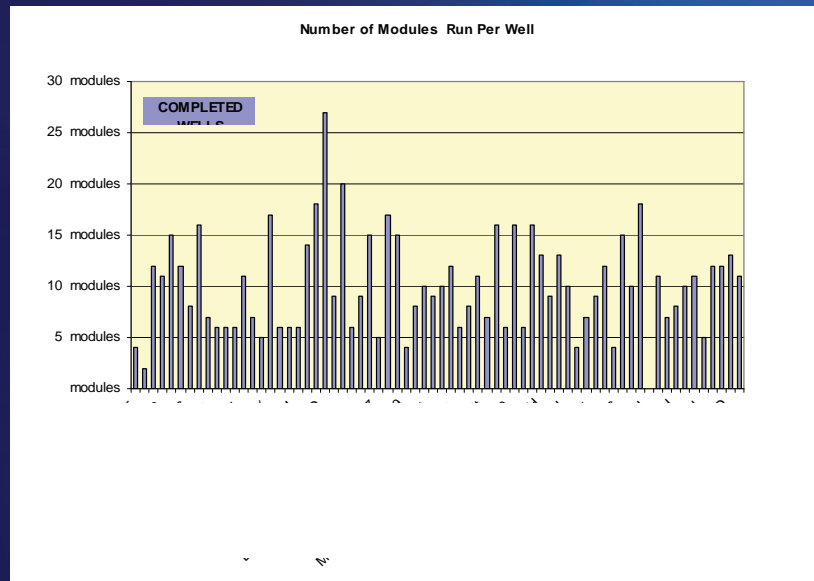
Escape Completion Process Well Name	Location	Depth	Modules Completed (Zones Completed)	IP	Escape: Estimated Venting Before Sales	Total Vent time
KBU 42-7	Alaska	7,500 feet	15 modules	3,150 MCFD	700 MCF	


# Estimated Gas Not Vented



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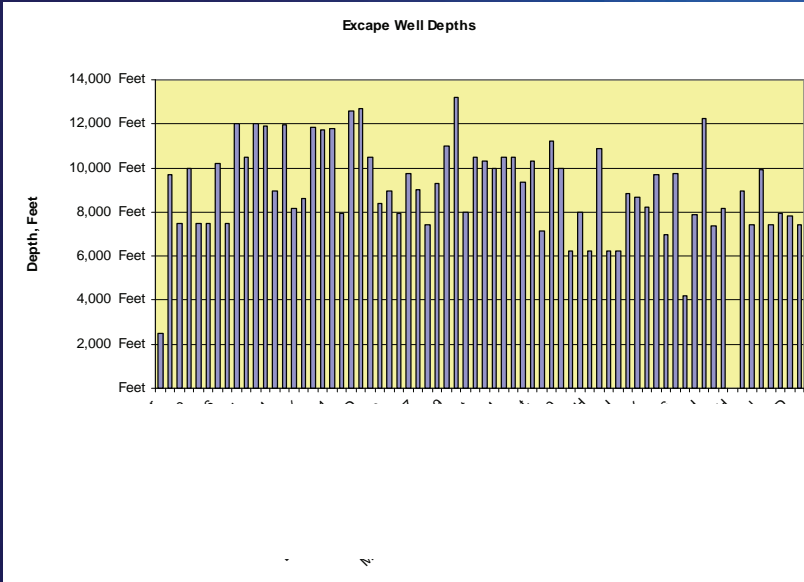
# Modules Run Per Well



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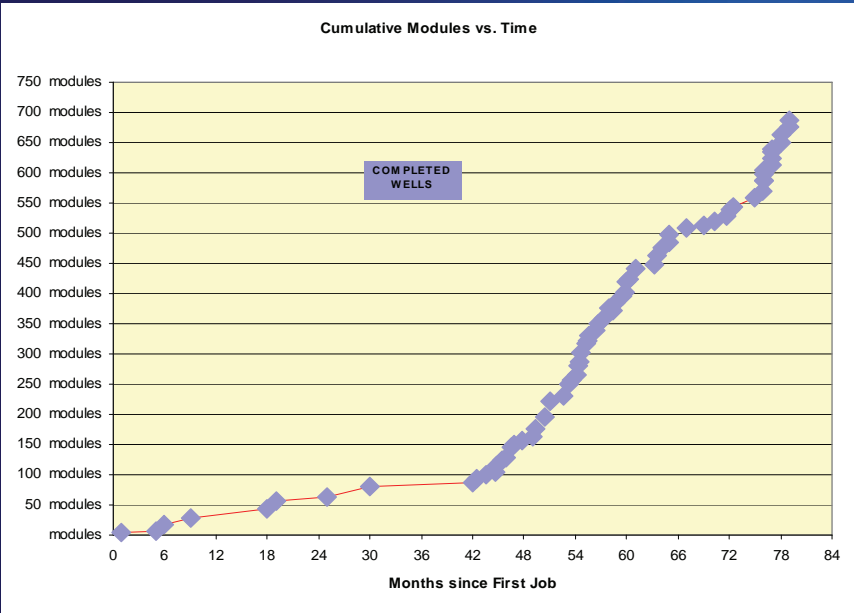


# Well Depths



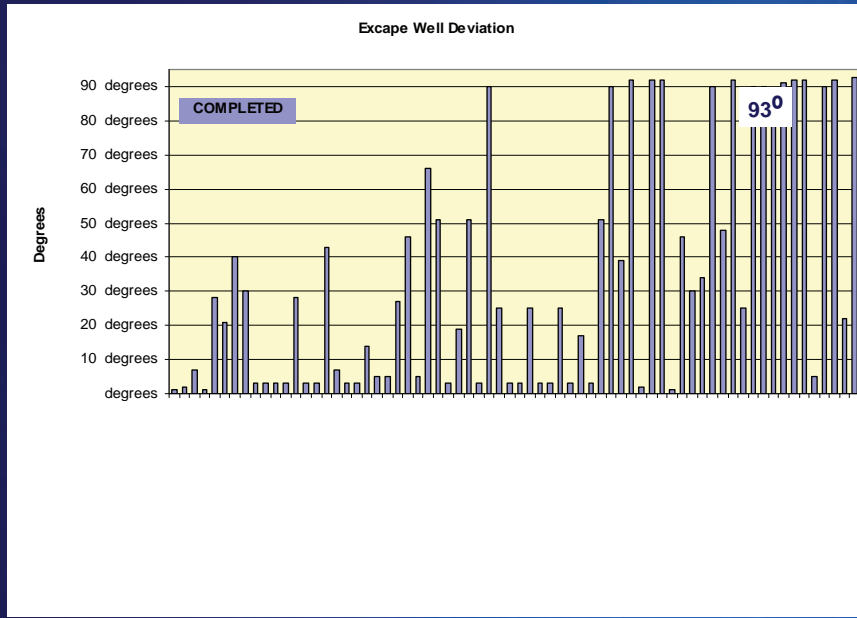
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# Technology Acceptance: Modules vs. Time



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# Excaped Well Deviations



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# Excaped: Technical Operating Efficiencies



Review Date:	Industry 3/13/2006	Marathon Only 3/13/2006	Horizontal 3/13/2006
Number of Modules Installed	677	373	146
Number of Modules Attempted to be Fired w/control line	631	340	113
Number of Modules Successfully Fired w/control line	589	339	102
Percent successfully fired	93.3%	99.7%	90.3%
Number of Fracture Stimulations	602	315	106
Number of Premature Screenouts on Frac Jobs	22	15	0
Percent of Frac Jobs which Screened out Prematurely	3.7%	4.8%	0.0%

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## Recent and Upcoming System Improvements

- ◆ Disappearing Isolation Valves
  - No need for coil clean-out
- ◆ Chemical Injection from lowermost interval
- ◆ Intermittent Gas lift from bottom, bottom interval is the “compressor”.
- ◆ Mechanical or remote zonal isolation
- ◆ Other still confidential system improvements

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## Conclusion

*This Escape Technology is reliable, and has safety and environmental benefits  
(~50% reduction in man hours, less exposure)*

*It has led to development of competing multi-zone stimulation techniques, which is beneficial to industry as a whole.*

*The amount of gas which can avoid being vented is very significant.*

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